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Wastewater Characterization Survey, Luke AFB AZ

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Final Report

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13. ABSTRACT *(Maximum 200 words)*

At the request of USAF Hospital Luke/SGPB, personnel from AFOEHL conducted a wastewater characterization survey at Luke AFB. The scope of the survey was to characterize the wastewater, analyze industrial effluent, effluent from oil/water separators, and storm water. The survey showed Luke AFB needed to take some follow-up action to reduce levels of ammonia, cyanide, boron, sulfide, and surfactants. Recommendations include: (1) Examine the soaps and cleaners being used to determine if phenol is present. Substitute non-phenolic soaps to reduce the concentration of phenols being discharged into the sanitary and storm drainage systems. (2) The contamination found was mostly ammonia, cyanide, boron, sulfides and surfactants; usually found in detergents and cleaners. Since all contaminants exceeded the limits, determine what detergents and cleaners contain these chemicals and replace them. (3) Clean and maintain the grease traps at the dining facilities. If there are none, then install some. (4) Perform routine maintenance on the oil/water separators and do periodic inspections to determine their effectiveness. (5) Determine the electronic components causing the high barium level at the Flight Simulator and prevent it being disposed of down the sanitary sewer. (6) Take two additional samples for mercury at Burger King and the Hush House.

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I. INTRODUCTION

At the request of USAF Hospital Luke/SGPB through HQ TAC/SGPB, AFOEHL/EQE conducted a wastewater characterization study of their wastewater and stormwater sewerage systems (Appendix A). This study was needed to identify the sources of various contaminates present in both stormwater and sanitary sewer discharge. Luke's wastewater treatment plant was exceeding several parameters of their National Pollution Discharge Elimination System (NPDES) permit at the time the study was conducted; including copper, phenol, ammonia, and chlorine. Luke AFB's new NPDES permit is more stringent than the previous permit. The Arizona Department of Environmental Quality (ADEQ) has investigated an unlined discharge channel coming from the outfall south of oil/water separator 912. During this inspection ADEQ identified some petroleum-based residues in the vicinity of ground fissures in the unlined channel. ADEQ assumes the material was discharged from Luke AFB and has expressed concern about the origin of such discharge.

The scope of the wastewater survey was to characterize the effluent from oil/water separators not under contract, industrial shops, and points along the storm and sanitary sewer system. This study also evaluated the influent and effluent of the wastewater treatment plant.

The survey was conducted from 4 to 19 Dec 1989. The wastewater characterization survey team included Maj John P. Garland III, 1Lt Shelia P. Scott, Lt Darrin L. Curtis, SSgt Mary Fields, Sgt Pete Davis, Sgt Harold Casey, Sgt Stanley Dabney, and Amn Christopher Feagin. Base points of contact were 1Lt Alan C. Thomas (Base Bioenvironmental Engineer), Col Robert J. Barnum (832D Combat Support Group Commander), Lt Col Larry Black (832D Combat Support Group Deputy Commander), Lt Col Ronald Descheneaux (Civil Engineering Commander), Capt David Dixion (Civil Engineering, Chief Environmental Planning), Mr David Lewis (Environmental Protection Specialist), Mr Meloche (Utilities Superintendent), TSgt Paul Brown (Sewage Treatment Plant Foreman) and Mr Charlie Brown (Sewage Treatment Plant Shift Leader).

II. DISCUSSION

A. Background

Luke AFB is situated in an arid area approximately 18 miles west of downtown Phoenix AZ. Luke covers an area approximately 2,036 acres (excluding family housing areas). The weather at Luke is ideal for flying year round.

B. Sewerage System

Luke AFB has separate sanitary and storm drainage systems. Domestic sewage with a possible combination of industrial wastewater is discharged through the sanitary sewer system to an Air Force operated wastewater treatment facility, located east of the base. Through primary and secondary processes, 0.85 MGD of sewage is treated and discharged to the Aqua Fria River daily.

The storm water drainage system for the base is a combination of underground drainage along with open channel canals (Figure 1).

C. Discharge Limitations

Luke is regulated by EPA Region 9 "Standard Federal NPDES Permit Conditions", dated January 29, 1988 and other effluent limitations and monitoring requirements set forth in their permit No. AZ0110221 discharge serial No. 001.

Summarized below in Table 1 are the effluent limitations for Luke AFB. The basis is NPDES Permit No. AZ0110221 outfall serial number 001.

Table 1. Effluent Limitations

Parameter	30-Day	7-Day	Daily Max
BOD	30 mg/l	45 mg/l	***
Suspended Solids	30 mg/l	45 mg/l	***
Fecal Coliform	1000/100 ml	N/A	4000/100 ml
Settleable Solids	1 ml/l	N/A	2 ml/l
Total Residual Chlorine			0.05 mg/l

The pH of the discharge must be greater than 6.0 and less than 9.0. The Biomonitoring will not be less than 50% survival as required and I.A.3.

Figure 1: Outfall from Sewage Treatment Plant

Table 2 lists the trace substances as specified in the permit.

Table 2. Trace Substances

Effluent Characteristics	Discharge Limitations daily max mg/l
Arsenics (as As)	0.05
Boron (as B)	1.00
Cadmium (as Cd)	0.01
Chromium*	0.05
Copper (as Cu)	0.05
Lead (as Pb)	0.05
Manganese (as Mn)	10.00
Mercury (as Hg)	0.0002
Selenium (as Se)	0.02
Silver (as Ag)	0.05
Zinc (as Zn)	0.50
Cyanide (total)	0.02
Phenolics (total)	0.005
Ammonia (as un-ionized NH_3)	0.02
Sulfides (total)	0.10

* Chromium as Cr, hexavalent and trivalent.

The discharge shall not cause objectionable odors at the surface of the receiving waters.

There shall be no discharge of floating solids, oil, grease or visible foam in other than trace amounts.

There shall be no discharges of toxic substances that violates the water quality standards of the State of Arizona, including those in A.C.R.R. 9-21-205.

The discharge shall not raise the natural ambient water temperature more than 3 degrees Celsius.

The discharge shall not cause the turbidity of the receiving water to exceed 50 nephelometric turbidity units.

The discharge shall not lower the dissolved oxygen concentration of the receiving water to less than 6 mg/l.

The discharge cannot exceed the following limitations:

a. Biochemical oxygen demand (BOD) maximum discharge limitations are 114 kg/day monthly, 170 kg/day weekly, and 341 kg/day daily based on the design capacity of 3,785 meters cubed a day.

b. The suspended solids limitations are the same as part (a) BOD.

III. PROCEDURES

A. Flow

The survey team attempted to take flow data at several sites in order to provide the base mass data (i.e., mg) in addition to concentration data (i.e., mg/l). However, site circumstances like stagnant lines, excessively deep manholes, multiple inflow sites, dangerous manhole rings and other problems made collection of flow data impossible. Table 3 shows flow data taken at specific sites or an explanation as to why flow measurements weren't taken.

1. Sampling Strategy. Main branch lines were sampled along with dining facilities and industrial shops that perform maintenance. The sewage treatment plant influent and effluent and 16 oil/water separators were sampled at the outfall portion of the aqueous phase.

2. Sampling Site Numbers and Locations. Table 4 gives complete description of sites and locations. Figure 2 shows sampling site locations.

3 Sampling Frequency. Equi-proportional composite samples were taken hourly for 24 hours at one to three day sample periods. There were approximately 48 sites sampled by using ISCO model 2700 and American Sigma automatic composite samplers. Grab samples were taken for oil/water separators.

4. Sampling Analyses. Appendix B shows the analyses for the sites. Appendix C shows the preservation for each analysis. Appendixes E, F, G, H, I, and J show all of the analytical tests and results taken on the survey.

Table 3. Flow Data

Site	Flow Data
58	We were unable to take flows from the housing area because manholes were backed up. This problem is caused by sewer lines sloping.
59	Pump Station 901 had other lines entering, therefore, we were unable to take flow measurements. A manhole was located in the street by Building 904b, but we were unable to take flow measurements due to depth of hole.
61	We were unable to take flow measurements at 2nd St, Building 585 manhole. This manhole had other lines entering it. 4th St and Building 546. Could not take measurements due to other sewer lines entering it. A flow reading was taken at the manhole at Building 514 (OSI Building). The total flow for 13-14 Dec 89 was 0001220 GPD.
64	2nd and K near Building 750: No flow measurements could be taken because of other sewer lines entering it.
65	Litchfield Road near Building 593: The manhole could not be found due to landscaping.
66	Near Building 799 East: No flow measurements could be taken at site 11. One manhole contained bad rungs and another had other sewer lines entering it.
67	O/W Separator Building 912: No flow in line at all. Bldg 179: Total flow from 13-14 Dec 89 was 64250 GPD.

Figure 2. Sampling Site Locations

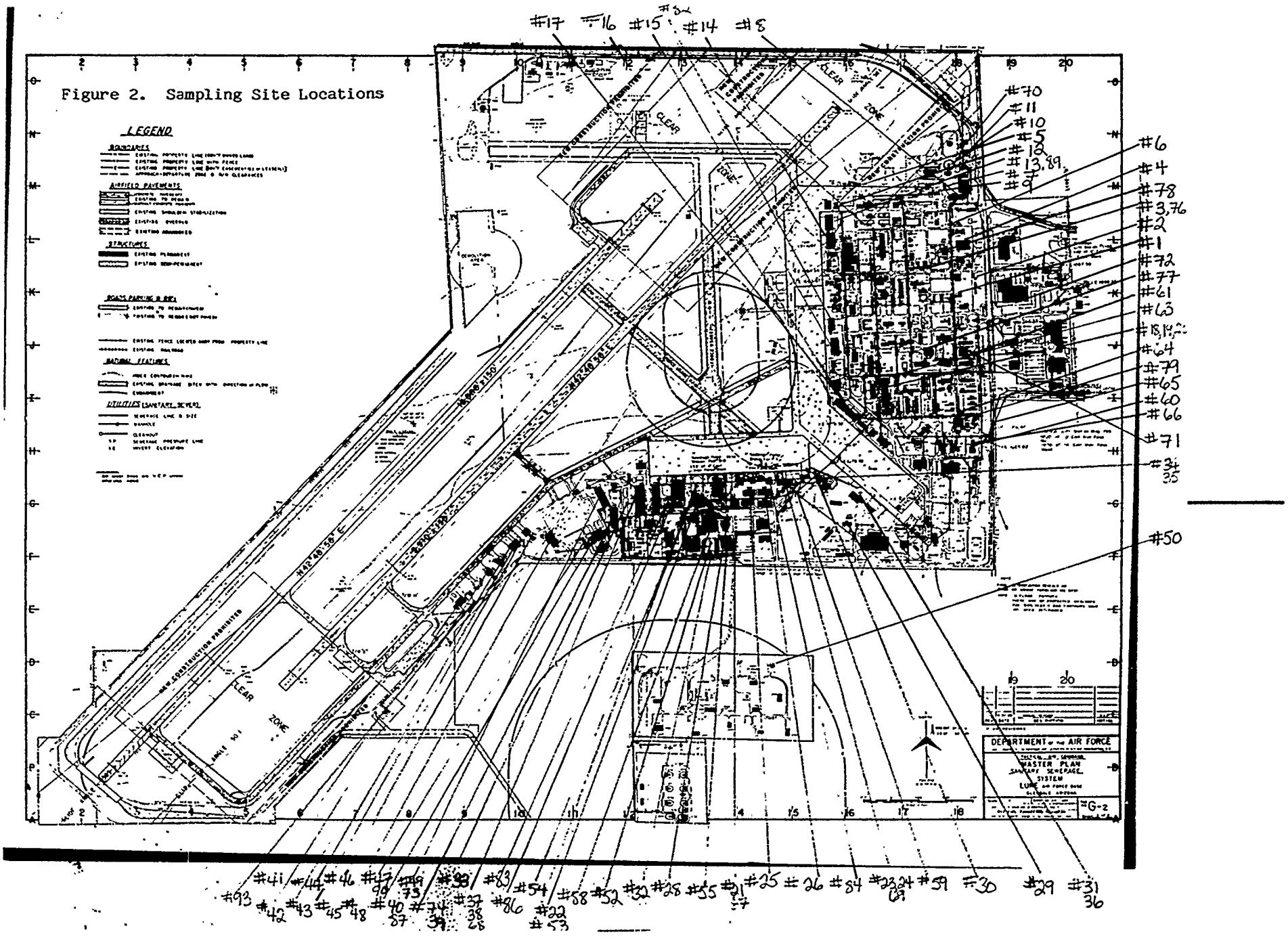

Table 4. Site Description

Site	Description
1	Bldg 177, AAFES Gas Station: Contracted
2	Bldg 192, Wash Rack: Contracted
3	Building 248, Auto Hobby Shop: On 9 Dec 89 at 1600 a grab sample was taken from this oil/water separator. At this time a thick oil sheen was noticed. pH 4.22, Temp 71.6°F.
4	Bldg 291, Vehicle Maint Shop: Contracted
5	Bldg 328, POL Operation: Contracted
6	Bldg 330, Vehicle Maint Yard: Contracted
7	Bldg 338, Pave & Equip Shop: Contracted
8	Bldg 339, BCE shops: Contracted
9	Bldg 341, BCE Wash Rack: Contracted
10	Bldg 351, POL Bulk Storage: Contracted
11	Bldg 353, Refueler Maint: Contracted
12	Bldg 403, AGE Wash Rack: A grab sample was taken from Site 12 at 1115 on 12 Dec 89. A strong fuel smell was noticed at this time.
13	Bldg 404, Support Equip Shop: A grab sample was taken from Site 13 at 1330 9 DEC 89. A fuel smell was noticed at this time. pH 5.84, Temp 69.8°F.
14	Bldg 408, A/C Maint Dock: A grab sample was taken from Site 14 at 1515 on 9 Dec 89. pH 7.16, Temp 71.6°F.
15	Bldg 431, A/C Maint Dock: A grab sample was taken from Site 15 at 1500 on 9 Dec 89. pH 5.70, Temp 68°F.
16	Bldg 485, A/C Maint & Trng: A grab sample was taken from Site 16 at 1430 on 9 Dec. The sample contained an oily substance resembling hydraulic fluid. pH 5.81, Temp 80.6°F.
17	Bldg 492, 405th Arm Shop: A grab sample was taken from Site 17 at 1100 on 12 Dec 89. This oil/water separator had an oil and sewage smell.

Table 4 Cont'd

Site	Description
18, 19, 20	Bldg 617, Flt Simulator: A grab sample was taken from Site 18, 19 and 20 at 1030 on 12 Dec 89. An oil sheen was noticed at this time.
21	Bldg 912, Industrial Waste Treatment: Contracted and composite sample taken.
22	Bldg 915, A/C Maint Dock: A grab sample was taken from Site 22 at 1030 on 9 Dec 89. pH 8.27, Temp 75.2°F.
23	Bldg 922, Corrosion Control: A grab sample was taken from Site 23 at 1330 on 9 Dec 89, and an oil sheen was noticed. pH 8.6, Temp 66.2°F.
24	Bldg 922, Corrosion Control: A grab sample was taken from Site 24 at 1340 on 9 Dec 89. This oil/water separator contained what looked to be a solvent. The oil/water separator was very rusty and pieces of it were falling off. pH 8.86, Temp 68°F.
25	Bldg 926, Armament Shop: A grab sample was taken from Site 25 at 1320 on 9 Dec 89. The oil/water separator at this site drained into the stormwater lines.
26	Building 927, Org. Maint Shop: A grab sample was taken from Site 26 at 1300 on 9 Dec 89. This oil/water separator drains into the stormwater lines. An oil sheen was noticed at time of sampling. pH 8.6, Temp 60.8°F.
27	Bldg 931, Engine Shop: Contracted
28	Bldg 940, Flight Simulator: Storage Tank
29	Bldg 947, Battery Storage: Storage Tank
30	Bldg 966, NDI Lab: A grab sample was taken from Site 30 at 1400 on 9 Dec 89. This is a very small oil/water separator. An oil sheen was noticed. pH 7.53, Temp 68°F
31	Bldg 968, Fuel Barn: A grab sample was taken from Site 31 at 1415 on 9 Dec 89.
32	Bldg 970, AGE Yard: Contracted
33	Bldg 982, Hydrazine Facility: Storage Tank
34	Bldg 983, A/C Maint Dock: Contracted
35	Bldg 983, A/C Maint Dock: Contracted
36	Bldg 984, Fuel Barn: Contracted

Table 4 Cont'd

Site	Description
37	Bldg 985, A/C Maint Dock: Contracted
38	Bldg 985, A/C Maint Dock: Storage Tank
39	Bldg 993, Comp Maint Facil: A grab sample was taken from Site 39 at 1002 on 8 Dec 89. pH 6.85, Temp 77°F.
40	Bldg 999, A/C Maint Dock: Contracted
41	Bldg 1003, Power Check Pad: Contracted
42	Bldg 1006, Hush House: Storage Tank
43	Bldg 1008, Power Check Pad: Contracted
44	Bldg 1009, Power Check Pad: Contracted
45	Bldg 1012, Hush House: Contracted
46	Bldg 1016, Hush House: Contracted
47	Bldg 1018, AGE Shop: Contracted
48	Bldg 1019, Fuel Barn: Contracted
49	Bldg 1022, A/C Maint Dock: Contracted
50	Bldg 1233, Vehicle Wash Rack: Contracted
51	Manhole Near Bldg 935: No sample taken due to standing water.
52	Manhole Near Bldg 972: Sampled for fecal coliform on 14 Dec 89.
53	Catch Basin 8 near Bldg 919: A sediment sample was taken at 1530 on 13 Dec 89, the approximate water depth is 15 inches (Figure 3).
54	Catch Basin 13 near Bldg 935: A composite sample was taken with the start time of 1020 on 12 Dec 89 and ended at 1000 on 13 Dec 89. Water temperature was 50°F.
55	Catch Basin 17 near Bldg 959: A grab sample was taken at 1100 on 13 Dec 89. Temperature was 73.4°F. On 12 Dec 89 a grab sample was taken with a temperature of 73.4°F and a pH of 7.12.
56	Influent to sewage treatment plant: A composite sample was started at 1500 on 11 Dec 89 and ended at 0900 on 12 Dec 89. Temperature was 78.8°F. Composite samples were also taken at this site on the following two days.

Table 4 Cont'd

Site	Description
57	Effluent from sewage treatment plant: A composite sample was taken on the 12, 13, and 14 Dec 89. Temperature was 56°F. Two grab samples were taken for oils and greases.
58	In Housing Area: A composite sample was taken, start time was 0900 on 12 Dec 89 and ended at 0945 on 13 Dec 89. Temperature was 71.6°F, pH 6.92. A composite sample was also taken on 12 Dec 89. The cover to the manhole needs replacing.
59	Pump Station Bldg 901: A composite sample was taken from 1500 on 11 Dec 89 to 1130 on 12 Dec 89. On 13 Dec 89 a grab sample was taken at 1100. Temperature 69.8°F, pH 6.31.
60	Pump Station, Bldg 793: A composite sample was started at 1500 on 11 Dec 89 and ended at 1130 on 12 Dec 89. Temperature 77°F, pH 7.2. There was a strong volatile smell in the manhole followed by a burning nasal sensation upon leaving.
61	2nd Street near Bldg 585: A composite sample was started at 0940 on 11 Dec 89 and ended at 0900 on 12 Dec 89. pH 7.2. Manhole had strong petroleum odor and petroleum sheen.
62	Planning site, no samples taken.
63	The corner of 5th and I streets: A composite sample was started at 1000 on 11 Dec 89 and ended at 1000 on 12 Dec 89. Temperature 65°F, pH was between 8.2 and 8.6, and there was no chlorine present. There was a petro sheen with a slight odor present at the site.
64	The corner of 2nd and K Streets: A composite sample was started at 1000 on 11 Dec 89 and ended at 0830 on 12 Dec 89. Temperature 62.7°F, pH 8.28, and there was no chlorine present. There was a medium flow with a raw sewage odor present at this site.
65	Bldg 593: Grab samples were taken due to malfunction of the ISCO on 12 Dec 89. Temperature 70.5°F, pH 7.9, and no chlorine was present. There was a heavy flow present with regular sewage odor.
66	Near Bldg 799, second manhole near lift station: Due to a low flow, the sample was essentially a grab sample. Temperature 80.7°F, pH 8.6, no chlorine present.
67	Oil/water separator at Bldg 912: A composite sample was started at 0915 on 11 Dec 89 and ended at 1025 on 12 Dec 89. Temperature 60°F, pH 7.2, and no chlorine present. There was a petroleum smell to the influent to the oil/water separator.

Table 4 Cont'd

Site	Description
68	Bldg 985: Due to very low flow grab samples were taken. Temperature 65.6°F, pH 8.96, and no chlorine was present. Site had a regular sewage smell, but had toilet paper interrupting the flow of water.
69	No Sample Taken.
70	Planning site, no samples taken.
71	Planning site, no samples taken.
72	In Front of Hospital: A grab sample was taken because of low flow. Temperature of 71.6°F, pH 6.0, and no chlorine was present.
73	Planning site, no samples taken.
74	Bldg 993: Due to low flow of water, grab samples were taken. Temperature of 76.4°F, pH 8.54, and no chlorine was present. There was a normal sewage odor present at the site.
75	Burger King: Due to malfunction of the ISCO, grab samples were taken. Temperature 74.4°F, pH 7.29, and no chlorine was present. There was a normal sewage odor present.
76	Between Bldgs 249 & 242: A grab sample was taken due to low flow of water. Temperature 69.8°F, pH 8.89, and no chlorine was present. There was a normal sewage odor present.
77	Dining facility: A composite sample was started at 1435 on 13 Dec 89 and ended at 0930 on 14 Dec 89. Temperature 77°F, pH 8.0, and no chlorine was present. Manhole was partially covered with asphalt. Water used to wash the utensils drained to the manhole where it settled approximately 50 yds away from building.
78	NCO Club along side of vehical maintenance: A composite sample was started at 1345 hrs 12 Dec 89 and ended at 1110 hrs 13 Dec 89. Temperature 77°F, pH 8.37, and no chlorine was present. There was a normal sewage odor present.
79	Planning site, no Sample Taken.
80	Commissary: A composite sample was started at 0945 on 13 Dec 89 and ended at 0940 on 14 Dec 89. Temperature 57°F.
81	The corner of 8th and I streets: A composite sample was started at 1345 on 13 Dec 89 and ended on 14 Dec 89. Temperature 60°F.

Table 4 Cont'd

Site	Description
82	Fire Station, Bldg 450. This line also includes bldgs 404, 408, 416, 407, 422, 428, 424, 433, 432, 442, 435, 439, 443, 444: A composite sample was started at 1550 on 13 Dec 89 and ended at 1415 on 14 Dec 89.
83	Planning site, no samples taken.
84	Planning site, no samples taken.
85	Bldg 339, Zone 4-Tiger: A composite sample was started at 1130 on 11 Dec 89 and ended at 1130 on 12 Dec 89. Temperature 62°F, pH between 8.2 & 8.6. When the ISCO was set out initially, the sewage was normal, but at approximately 1430 a white chalky substance similar to thick soap was apparent.
86	Planning site, no samples taken.
87	Planning site, no samples taken.
88	Planning site, no samples taken.
89	Bldg 404 at the corner of B and 8th streets: A composite sample was started at 1315 on 13 Dec 89 and ended at 0910 on 14 Dec 89. Temperature 62.6°F, pH 8.0 and no chlorine was present. There was a very low flow due to large amounts of paper in the sewer line.
90	Planning site, no samples taken.
91	Planning site, no samples taken.
92	Planning site, no samples taken.
93	Bldg 956
94	Hush House: A grab sample was taken at 1040 on 13 Dec 89 (Figure 4).
95	Bldg 353
96	Bldg 339
97	Bldg 343
98	Bldg 346
99	Bldg 931: A grab sample was taken from a drum containing wash water on 14 Dec 89.

Table 4 Cont'd

Site	Description
100	Bldg CB 6 Sludge
101	STP Sludge
102	Pizza Hut
103	Outfall of STP

Figure 3. Catch Basin 8

Figure 4. Hush House Outfall

IV. CONCLUSIONS

Tables 5, 6, 7, and 8 show the parameter excursions at each site. The discussion below gives more specifics to tie together possible sources of contamination and any unusual observations noted while collecting the samples.

A. High Chemical Oxygen Demand (COD) (>700 mg/l) may be attributed to the use of aircraft soap and Citrikleen that discharges into the oil/water separators then to the sanitary sewer.

B. High ammonia concentrations (>20 µg/l) may be found as a constituent in some soaps and cleaners.

C. High cyanide concentrations (>20 µg/l) may be found in film bleaching chemicals and laundry detergent or soaps of certain strengths. From the AFOEHL Hazardous Waste Survey, no particular soap was identified from these shops. From other shops the most common chemicals used for cleaning are Calla 800, Citrikleen and aircraft soap.

D. High phenol concentrations (>5 µg/l) were found at practically every sampling site throughout the base. Phenol is a constituent of soaps and cleaners.

E. High boron concentrations (>100 µg/l) may be found as a constituent in fixers and developers and biodegradable aircraft soaps and cleaners.

F. High MBAS concentrations (>2 mg/l) were found at sites where cleaning operations took place.

G. High sulfide concentrations (>100 µg/l) can be found in detergents.

H. High oil and grease levels (>15 mg/l) were found at dining facilities and maintenance organizations. Since oil and grease is a combination of fats from food stuffs and petroleums, these are the source of the highest occurring excursions.

I. High petroleum hydrocarbons levels (>15 mg/l) were found at maintenance organizations and parts cleaning shops.

J. High conductivity levels (>1000 µmhos) were found at places where washing and electronic circuitry are located.

K. High barium levels (>2 mg/l) were found at the Flight Simulator. Barium is used in electronics. Since the Flight Simulator is mostly electronic equipment this is the possible source of contamination.

L. High iron levels (>1.0 mg/l) were found throughout the base. Low or high pHs can cause corrosion to occur.

M. High manganese levels were found at the Auto Hobby Shop only. Manganese is a constituent in steel alloys possibly from engine parts and gears.

N. High zinc levels were found at the sites where operations of maintenance and cleaning occur.

O. High titanium levels were found at two shops, Zone 4 - Tiger and 405 Equipment Maintenance Squadron, Bldg 404. The processes done in these shops are repairing, maintaining flight line support equipment and electrical, plumbing, refrigeration and heating operations. Titanium is a constituent in thermal insulators, heat resistent surface coatings in paints and plastics, and aircraft tubing and fittings.

P. High mercury levels were found at unusual sites such as the Burger King, and the Hush House. Mercury can be found in manometers, thermometers and some chemical processes.

Q. The most common volatile halocarbons found as shown in Table 7 are typical constituents in solvents for cleaning and degreasing, photography and photo copy processes and fuels.

R. The most common volatile aromatics found as shown in Table 8 are typical constituents in insecticides, automotive and aviation gasolines, and degreasers. Most of the sites have some volatile aromatics in their wastewater.

S. The bioassay results indicated that at 25% dilution of wastewater to deionized water showed only 60% survival rate. The 50% dilution of wastewater to deionized water showed no survival rate. This was at the 24-hour period. At the 48-hour period the 25% dilution showed only 30% survival rate. Appendix I shows the data. The requirement in the NPDES permit was for not less than 50% survival rate for biomonitoring. As stated previously the 50% dilution had no survival rate for either the 24- or 48-hour period.

T. The fecal coliform results (Appendix J) indicate large numbers and in some instances too numerous too count (TNTC' was found. The NPDES permit requires an effluent of fecal coliform to be 4000/100 ml maximum. The sewage treatment plant effluent (site 57) results show 0/100 ml. The sewage treatment plant influent (site 56) show TNTC and values in the billions and greater.

U. Two 24-hour composite samples were taken from the oil/water separator at bldg 912 (site 67). The petroleum hydrocarbon concentration was high on one of the two days. Other contaminants such as phenol, boron, MBA3, ethyl benzene and sulfides were extremely high also. At the time of sampling, a contractor was pumping out the oil/water separator. (Figure 5)

Table 5
Results That Have Exceeded Limits

Site / Parameter	Units	3	12	13	14	15	16
BOD	mg/l	----	----	----	----	----	----
COD	"	7075	----	4150	----	3800	----
Ammonia	"	6	----	16	----	33	2.8
Cyanide	"	----	----	----	----	----	----
Phenol	µg/l	225	165	166	37	320	675
Boron	"	10250	1150	12000	300	1400	400
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	3219	470	1919	----	1745	----
MBAS	"	216	26	164	----	9.8	7.6
Sulfides	"	0.1	----	----	0.1	3.1	1.7
O&G	"	415	168	238	332	2160	416
Petro Hydro	"	316	143	115	----	250	1248
Conductivity	µmhos	1450	----	----	----	1019	----

Site / Parameter	Units	17	18	22	23	24	25
BOD		----	----	----	----	----	----
COD	mg/l	2650	14500	----	----	----	----
Ammonia	"	22	3	2	----	2	5.6
Cyanide	"	0.04	----	----	----	----	0.03
Phenol	µg/l	295	73	38	17500	16	17
Boron	"	3100	67000	3200	----	700	400
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	1723	3881	551	549	574	508
MBAS	"	4.3	5.8	----	----	5.2	----
Sulfides	"	4.5	----	----	----	0.1	6.1
O&G	"	416	----	----	----	----	296
Petro Hydro	"	166	----	----	----	----	30.7
Conductivity	µmhos	----	15000	----	----	----	----

Site / Parameter	Units	26	30	39	54	55	55
BOD		----	----	----	----	612	358
COD	mg/l	----	----	----	1650	2520	1100
Ammonia	"	5.6	16.8	0.24	0.28	2.3	1.8
Cyanide	"	0.028	----	----	----	----	----
Phenol	µg/l	13	20	----	33	66	80
Boron	"	1900	650	350	500	650	650
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	486	472	957	1143	1171	1035
MBAS	"	----	----	----	320	1120	230
Sulfides	"	0.1	6.7	0.1	1.0	8.1	1.1
O&G	"	31.8	----	48	16.7	----	251
Petro Hydro	"	----	----	----	----	----	----
Conductivity	µmhos	----	----	----	1081	----	----

Table 5, Continued

Site		56	56	56	56	57	57
Parameter	Units						
BOD		156	118	----	----	51	28
COD	mg/l	----	----	----	----	----	----
Ammonia	"	26.8	25.6	26.6	----	22.4	20
Cyanide	"	----	----	----	----	----	----
Phenol	µg/l	33	45	45	----	10	----
Boron	"	700	850	1000	----	2400	----
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	----	----	----	----	----	----
MBAS	"	----	----	18	----	----	----
Sulfides	"	0.7	0.5	6.6	----	----	----
O&G	"	----	48	72	----	----	----
Petro Hydro	"	----	----	----	----	----	----
Conductivity	µmhos	----	----	----	----	----	----

Site		57	57		58	58	59
Parameter	Units						
BOD		----	----		210	380	88
COD	mg/l	----	----		----	----	----
Ammonia	"	19.6	17.1		21.6	19.6	56.8
Cyanide	"	----	----		----	----	----
Phenol	µg/l	----	10		54	70	42
Boron	"	1850	1350		1050	1250	1700
Residue, Settleable	mg/l	----	----		----	----	----
Residue, Total	"	----	----		----	----	----
MBAS	"	----	----		----	6.8	----
Sulfides	"	----	----		2.1	----	0.7
O&G	"	----	----		268	86	----
Petro Hydro	"	----	----		17.6	14.2	----
Conductivity	µmhos	----	----		----	----	1063

Site		59	60	60	61	61	63
Parameter	Units						
BOD		133	276	212	603	241	159
COD	mg/l	----	----	----	----	----	----
Ammonia	"	56	22	31.2	12.8	15.6	81.3
Cyanide	"	----	----	----	----	----	----
Phenol	µg/l	60	31	33	10	----	123
Boron	"	5750	850	1400	650	----	1050
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	623	1339	----	10406	----	1849
MBAS	"	----	----	----	----	----	----
Sulfides	"	0.1	10.8	0.7	1.1	----	1.7
O&G	"	51.6	356	65.6	131.2	179.2	25.2
Petro Hydro	"	----	46.4	----	----	89.4	----
Conductivity	µmhos	1245	----	----	----	----	1383

Table 5, Continued

Site / Parameter	Units	63	64	64	65	65	66
BOD		274	65	101	239	176	277
COD	mg/l	----	----	----	----	----	----
Ammonia	"	66	46	22.8	27	21.4	10
Cyanide	"	----	----	----	----	----	----
Phenol	µg/l	52	37	37	23	52	----
Boron	"	1050	1400	1625	850	650	500
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	523	579	510	635	476	----
MBAS	"	----	----	----	----	----	----
Sulfides	"	4	0.5	----	3.1	1	----
O&G	"	65.6	96	57.6	240	65.6	----
Petro Hydro	"	----	35.6	----	87.6	----	----
Conductivity	µmhos	1300	----	1169	----	----	----

Site / Parameter	Units	66	67	67		72	74
BOD		175	489	201		110	----
COD	mg/l	----	710	----		----	----
Ammonia	"	13	0.36	7.8		----	185
Cyanide	"	----	----	----		----	----
Phenol	µg/l	----	240	187		----	31
Boron	"	550	650	900		----	1400
Residue, Settleable	mg/l	----	----	----		----	----
Residue, Total	"	----	521	821		580	----
MBAS	"	----	1250	----		----	----
Sulfides	"	----	0.1	1.6		----	1.3
O&G	"	89.6	----	208		----	----
Petro Hydro	"	----	----	179.2		----	----
Conductivity	µmhos	----	1013	----		----	1175

Site / Parameter	Units	74	75	76	77	78	79
BOD		----	179	128	62	----	183
COD	mg/l	----	----	----	----	----	----
Ammonia	"	9.4	12.8	64	14	10.4	49
Cyanide	"	----	----	----	0.27	----	----
Phenol	µg/l	60	80	24	27	----	170
Boron	"	1350	750	1850	750	750	2000
Residue, Settleable	mg/l	----	----	----	----	----	----
Residue, Total	"	----	----	----	428	436	475
MBAS	"	----	----	----	----	----	----
Sulfides	"	----	0.3	----	1.6	0.4	0.2
O&G	"	----	----	70.4	----	70.4	27.2
Petro Hydro	"	----	----	----	----	----	----
Conductivity	µmhos	1081	1700	1150	----	----	----

Table 5, Continued

Site Parameter	Units	80	81	82	85	85
BOD		124	157	----	707	----
COD	mg/l	----	----	----	----	----
Ammonia	"	18.8	84	73	22	37.5
Cyanide	"	----	----	----	----	----
Phenol	µg/l	109	102	63	48	109
Boron	"	500	1200	900	4300	2300
Residue, Settleable	mg/l	----	----	----	----	----
Residue, Total	"	461	823	600	----	----
MBAS	"	----	----	----	2.9	----
Sulfides	"	0.4	1.8	----	0.7	----
O&G	"	----	17.7	----	----	70.4
Petro Hydro	"	----	----	----	----	----
Conductivity	µmhos	1175	1875	1550	1363	1500

Table 6. Exceeded Metals Results

Site		3	13	15	16	17	18
Parameter	Unit						
Arsenic	µg/l						
Barium	µg/l						2690
Beryllium	"						
Cadmium	"						
Calcium	mg/l						15920
Chromium	µg/l						
Copper	"						
Iron	"	167200	11840	6589	4337	2997	161200
Manganese	"	1134					
Nickel	"	3500					3000
Zinc	"		2817				
Aluminum	"	1640	3008	1045		4131	
Cobalt	"						
Titanium	"		9498				
Vanadium	"						
Molybdenum	"						
Mercury	"		22.9				1.8
Magnesium	mg/l						4964

Site		22	24	25	26	30	56
Parameter	Unit						
Arsenic	µg/l						
Barium	µg/l			1339	1803		
Beryllium	"						
Cadmium	"						
Calcium	mg/l						
Chromium	µg/l						
Copper	"						
Iron	"	1523	6719	1035	1780	1869	1205
Manganese	"						
Nickel	"						
Zinc	"						
Aluminum	"						
Cobalt	"						
Titanium	"						
Vanadium	"						
Molybdenum	"						
Mercury	"						
Magnesium	mg/l						

Table 6, Continued

Site		57A	57	60	63	67	72
Parameter	Unit						
Arsenic	µg/l						
Barium	µg/l						
Beryllium	"						
Cadmium	"						
Calcium	mg/l						
Chromium	µg/l						
Copper	"						
Iron	"			26150	8201	5107	8102
Manganese	"						
Nickel	"						
Zinc	"			1395			
Aluminum	"			2814			
Cobalt	"						
Titanium	"						
Vanadium	"						
Molybdenum	"						
Mercury	"	2.4	2.3				
Magnesium	mg/l						

Site		75	76	77	83	85	94
Parameter	Unit						
Arsenic	µg/l						
Barium	µg/l						
Beryllium	"						
Cadmium	"						
Calcium	mg/l						
Chromium	µg/l						
Copper	"						
Iron	"			3592			
Manganese	"						
Nickel	"						
Zinc	"						
Aluminum	"						
Cobalt	"						
Titanium	"					3165	
Vanadium	"						
Molybdenum	"						
Mercury	"	1.3	2.1		2.1		1.8
Magnesium	mg/l						

Table 7. EPA Method 601

Site		3	16	23	24	30
Parameter	Unit					
Bromodichloromethane	µg/l					
Bromoform	"					
Carbon Tetrachloride	"					
Chlorobenzene	"					0.9
Chloroethane	"					
Chloromethane	"					
Chloroform	"					
Chlorodibromomethane	"	141				
1,2-Dichlorobenzene	"					
1,3-Dichlorobenzene	"					
1,4-Dichlorobenzene	"					
Dichlorodifluoromethane	"					
1,1-Dichloroethane	"	132				15
1,2-Dichloroethane	"					
1,1-Dichloroethene	"					1
trans-1,2-Dichloroethene	"			1.6		0.7
1,2-Dichloropropane	"					
cis-1,3-dichloropropene	"					
trans-1,3-dichloropropene	"					
Methylene Chloride	"	14	1	1044	2.4	1.4
1,1,2,2-Tetrachloroethane	"					
Tetrachloroethylene	"	1644				
1,1,1-Trichloroethane	"	699	2.1			998
1,1,2-Trichloroethane	"					
Trichloroethylene	"	169				
Trichlorofluoromethane	"					
Vinyl Chloride	"					
Bromomethane	"					
2-Chloroethylvinyl ether	"					
cis-1,2-Dichloroethene	"	883				

Site		55	56	57	58	59
Parameter	Unit					
Bromodichloromethane	µg/l					
Bromoform	"					
Carbon Tetrachloride	"					
Chlorobenzene	"					
Chloroethane	"					
Chloroform	"					
Chloromethane	"					
Chlorodibromomethane	"					
1,2-Dichlorobenzene	"					
1,3-Dichlorobenzene	"					
1,4-Dichlorobenzene	"					

Table 7, Continued

Site / Parameter	Unit	55	56	57	58	59
Dichlorodifluoromethane	"					
1,1-Dichloroethane	"					
1,2-Dichloroethane	"					
1,1-Dichloroethene	"					
trans-1,2-Dichloroethene	"	17				
Methylene Chloride	"					
1,1,2,2-Tetrachloroethane	"					
Tetrachloroethylene	"					
1,1,1-Trichloroethane	"					
1,1,2-Trichloroethane	"					
Trichloroethylene	"					
Trichlorofluoromethane	"					
Vinyl Chloride	"					
Bromomethane	"					
2-Chloroethylvinyl ether	"					
cis-1,2-Dichloroethene	"					

Site / Parameter	Unit	59	60	64	67
Bromodichloromethane	µg/l				
Bromoform	"				
Carbon Tetrachloride	"				
Chlorobenzene	"				
Chloroethane	"				
Chloroform	"				
Chloromethane	"				
Chlorodibromomethane	"				
1,2-Dichlorobenzene	"				
1,3-Dichlorobenzene	"				
1,4-Dichlorobenzene	"				
Dichlorodifluoromethane	"				
1,1-Dichloroethane	"				
1,2-Dichloroethane	"				
1,1-Dichloroethene	"				
trans-1,2-Dichloroethene	"				5
Methylene Chloride	"		8.5		
1,1,2,2-Tetrachloroethane	"				
Tetrachloroethylene	"				
1,1,1-Trichloroethane	"	34		23	
1,1,2-Trichloroethane	"				
Trichloroethylene	"				
Trichlorofluoromethane	"				
Vinyl Chloride	"				
Bromomethane	"				
2-Chloroethylvinyl ether	"				
cis-1,2-Dichloroethene	"				

Table 8. EPA Method 602

Site		3	12	14	17	23
Parameters	Units					
1,3-Dichlorobenzene	µg/l			3		
1,4-Dichlorobenzene	"	5.2		14		
Ethyl Benzene	"	2.7	4	1.9	960	0.7
Chlorobenzene	"	6				2.5
Toluene	"	34	29		80	1.3
Benzene	"		8			
1,2-Dichlorobenzene	"					

Site		56	56	56	57	58
Parameters	Units					
1,3-Dichlorobenzene	µg/l					
1,4-Dichlorobenzene	"					
Ethyl Benzene	"		6	8.7		
Chlorobenzene	"		8	9.2		
Toluene	"	69	21	17	3	3.5
Benzene	"					
1,2-Dichlorobenzene	"					

Site		59	60	60	61	64
Parameters	Units					
1,3-Dichlorobenzene	µg/l					
1,4-Dichlorobenzene	"					
Ethyl Benzene	"	3.4	15	11	3.2	67
Chlorobenzene	"					
Toluene	"	42	54	22	4	45
Benzene	"					
1,2-Dichlorobenzene	"					

Site		64	65	67	67	68
Parameters	Units					
1,3-Dichlorobenzene	µg/l					
1,4-Dichlorobenzene	"					
Ethyl Benzene	"	67	1.9		120	4
Chlorobenzene	"					
Toluene	"		5.8	9.2	270	
Benzene	"		5.8		60	
1,2-Dichlorobenzene	"					

Table 8, Continued

Site		72	85	85
Parameters	Units			
1,3-Dichlorobenzene	µg/l			
1,4-Dichlorobenzene	"			
Ethyl Benzene	"		75	4
Chlorobenzene	"			
Toluene	"	28		12
Benzene	"			6
1,2-Dichlorobenzene	"			

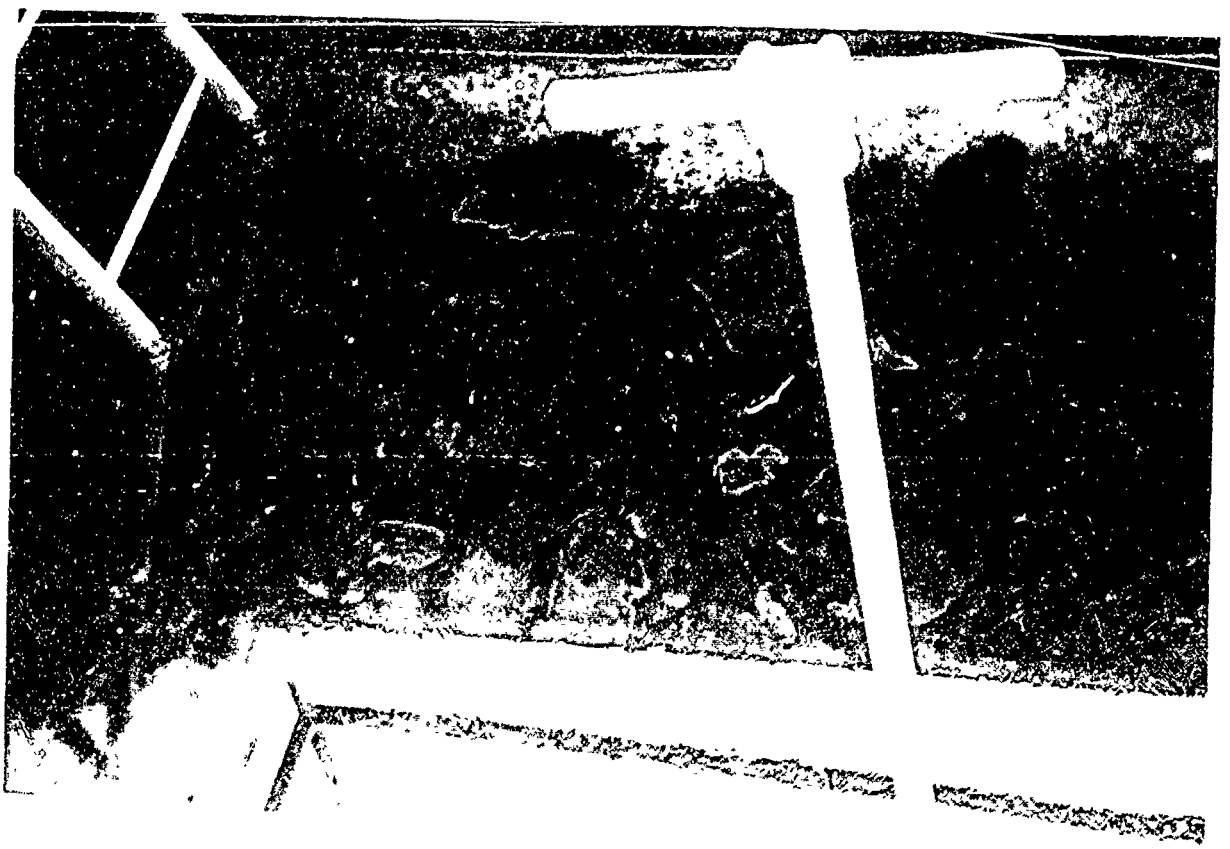

Figure 5. Oil/Water Separator at Bldg 912

V. RECOMMENDATIONS

A. From the analytical results, phenols were detected throughout the base. Examination of the soaps and cleaners being used should be done to determine if phenol is present. Non-phenolic soaps should be substituted to reduce the concentration of phenols being discharged into the sanitary and storm drainage systems.

B. Most of the contamination found were ammonia, cyanide, boron, sulfides and surfactants. These constituents are usually found in detergents and cleaners. Since the contaminants all exceeded the limits, determine what detergents and cleaners contain these chemicals and replace them.

C. Clean and maintain the grease traps at the dining facilities. If there are no grease traps, then install some to eliminate or reduce the oil and grease levels going into the sanitary sewer.

D. Perform routine maintenance on the oil/water separators and do periodic inspections on the effectiveness of these separators.

E. Determine what electronic components could be causing the high barium level at the Flight Simulator. Prevent barium from being disposed of down the the sanitary sewer.

F. Take two additional samples at Burger King and the Hush House for mercury to confirm mercury discharge. If mercury is again found, determine the source and dispose of it properly.

G. Dilute the cleaning detergents to decrease the high concentrations of surfactants.

APPENDIX A

Request Letter

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DEPARTMENT OF THE AIR FORCE

832D MEDICAL GROUP (TAC)
LUKE AIR FORCE BASE, AZ 85309-5300

REPLY TO
ATTN OF: SGPB

28 July 1989

SUBJECT: Request for Assistance of AFOEHL Wastewater Team

TO: HQ TAC/SGPB
~~AFOEHL/EC~~
IN TURN

1. Luke AFB requests the support of the AFOEHL in the form of a wastewater Characterization Study, to be scheduled at the earliest possible date. This study is needed to identify the sources of various contaminants present in both stormwater and sanitary sewage, and to locate sites of cross connection between these two streams.

2. Luke is currently in application for renewal of its sewage treatment plant NPDES permit. One of the conditions for renewal is thorough characterization of potential industrial discharges to the sanitary sewage system. EPA representatives have made it clear that effluent limit exceedances, which have been fairly common, will have to be tracked down under the new permit.

3. A concurrent issue is the potential discharge, by various means, of industrial wastes into the stormwater drainage system. This may be occurring through the normal routes of leaks, spills and unauthorized dumping, but we strongly suspect that it is also caused by cross-connections. Because of an incident several months ago, our stormwater discharge is being closely watched by the local regulators, and the coming stormwater discharge permitting system will only intensify this scrutiny.

4. Recent publicity caused by the EPA and Arizona Department of Environmental Quality's apparent "get tough on Luke" policy is additional impetus to resolve these problems. Although we know that OEHL's wastewater team has a very full agenda, we would appreciate your earliest possible assistance. If you need more documentation or have any questions, please call me at AV 853-7521.

ALAN C. THOMAS, 1 Lt, USAF, BSC
Chief, Bioenvironmental Engineering Svs

1st IND., HQ TAC/SGPB 15 AUG 1989

TO: USAF OEHL/CC

Forwarded for your action. OEHL support of this request will be greatly appreciated.

Readiness is our Profession

JERRY P. DOUGHERTY, COLONEL, USAF, BSC
CHIEF, BIOENVIRONMENTAL ENGR. SVC.

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89-1069

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APPENDIX B

Sites With Analytical Parameters

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SITE WITH ANALYTICAL PARAMETER

	Sites 1 - 10									
	1	2	3	4	5	6	7	8	9	10
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD										
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volatile Halocarbon	X	X	X	X	X	X	X	X	X	X
Volatile Aromatics	X	X	X	X	X	X	X	X	X	X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides										
Cyanide	X	X	X	X	X	X	X	X	X	X
Boron	X	X	X	X	X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X	X	X	X	X	X
Sample Taken	C	C	Y	C	C	C	C	C	C	C

C = Contract
Y = Yes
N = No

Sites 11 - 20

	11	12	13	14	15	16	17	18	19	20
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD		1								
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volatile Halocarbon	X	X	X	X	X	X	X	X	X	X
Volatile Aromatics	X	X	X	X	X	X	X	X	X	X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides										
Cyanide	X	X	X	X	X	X	X	X	X	X
Boron	X	X	X	X	X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X	X	X	X	X	X
SAMPLE TAKEN	C	Y	Y	Y	Y	Y	Y	Y	C	C

C = Contract
Y = Yes
N = No

Sites 21 - 30

	21	22	23	24	25	26	27	28	29	30
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD										
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volatile Halocarbon	X	X	X	X	X	X	X	X	X	X
Volatile Aromatics	X	X	X	X	X	X	X	X	X	X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides										
Cyanide	X	X	X	X	X	X	X	X	X	X
Boron	X	X	X	X	X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X	X	X	X	X	X
SAMPLE TAKEN	C	Y	Y	Y	Y	Y	C	C	C	Y

C = Contract
Y = Yes
N = No

Sites 31 - 40

	31	32	33	34	35	36	37	38	39	
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD										
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volatile Halocarbon	X	X	X	X	X	X	X	X	X	X
Volatile Aromatics	X	X	X	X	X	X	X	X	X	X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides										
Cyanide	X	X	X	X	X	X	X	X	X	X
Boron	X	X	X	X	X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X	X	X	X	X	X
SAMPLE TAKEN	Y	C	C	C	C	C	C	C	Y	C

C = Contract
Y = Yes
N = No

Sites 41 - 50

	41	42	43	44	45	46	47	48	49	50
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD										1
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volati .locarbon	X	X	X	X	X	X	X	X	X	X
Volati. .romatics	X	X	X	X	X	X	X	X	X	X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides										
Cyanide	X	X	X	X	X	X	X	X	X	X
Boron	X	X	X	X	X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X	X	X	X	X	X
SAMPLE TAKEN	C	C	C	C	C	C	C	C	C	C

C = Contract
Y = Yes
N = No

	Sites 51 - 60									
	51	52	53	54	55	56	57	58	59	60
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD	2	2	2	2	2	3	3	2	2	2
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volatile Halocarbon	X	X	X	X	X	X	X	X	X	X
Volatile Aromatics	X	X	X	X	X	X	X	X	X	X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides						X	X	X		
Cyanide	X	X	X		X	X	X	X	X	X
Boron	X	X	X		X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X		X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X		X	X	X	X	X	X
SAMPLE TAKEN	C	C	C	Y	Y	Y	Y	Y	Y	Y

C = Contract
Y = Yes
N = No

	Sites 61 - 70									
	61	62	63	64	65	66	67	68	69	70
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X		X	X
Settleable Solids	X	X	X	X	X	X	X		X	X
Conductivity	X	X	X	X	X	X	X		X	X
COD	X	X	X	X	X	X	X		X	X
BOD	2	2	2	2	2	2	2			
Oil & Grease	X	X	X	X	X		X	X	X	X
ICP Metals	X	X	X	X	X		X		X	X
Volatile Halocarbon	X	X	X	X			X	X	X	
Volatile Aromatics	X	X	X	X			X	X	X	
MBAS	X	X	X	X	X	X	X		X	
Pesticides							X			X
Cyanide	X	X	X	X			X		X	
Boron	X	X	X	X	X	X	X		X	
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X		X		X	X
Ammonia	X	X	X	X	X		X		X	X
Phenol	X	X	X	X	X		X		X	X
SAMPLE TAKEN	Y	N	Y	Y	Y	Y	Y	Y	N	N

C = Contract
Y = Yes
N = No

	Sites 71 - 80									
	71	72	73	74	75	76	77	78	79	80
pH	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids	X	X	X	X	X	X	X	X	X	X
Settleable Solids	X	X	X	X	X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X
BOD		1		1	1	1	1	1	1	1
Oil & Grease		X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X	X	X	X	X	X
Volatile Halocarbon	X	X	X	X		X				X
Volatile Aromatics	X	X	X	X		X				X
MBAS	X	X	X	X	X	X	X	X	X	X
Pesticides										
Cyanide	X	X	X	X	X	X	X	X	X	X
Boron	X	X	X	X	X	X	X	X	X	X
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity										
Sulfides	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X	X	X	X	X	X
SAMPLE TAKEN	N	N	Y	N	Y	Y	Y	Y	Y	Y

C = Contract
Y = Yes
N = No

	Sites 91 - 100									
	91	92	93	94	95	96	97	98	99	100
pH	X	X	X	X						
Temperature	X	X	X	X						
Total Suspended Solids	X	X	X	X						
Settleable Solids	X	X	X	X						
Conductivity	X	X	X	X						
COD	X	X	X	X	X				X	
BOD			1							
Oil & Grease	X	X	X	X	X	X	X	X	X	X
ICP Metals	X	X	X	X	X					
Volatile Halocarbon	X	X	X	X						
Volatile Aromatics	X	X	X	X						
MBS	X	X	X	X						
Pesticides										
Cyanide	X	X	X	X						
Boron	X	X	X	X						
Petroleum Hydrocarbons	X	X	X	X	X	X	X	X	X	X
Fecal Coliforms										
EP Toxicity						X				
Sulfides	X	X	X	X						
Ammonia	X	X	X	X	X			X		
Phenol	X	X	X	X		X	X			
SAMPLE TAKEN	N	N	N	N	Y	Y	Y	Y	Y	Y

C = Contract
Y = Yes
N = No

	Sites 101-102	
	101	102
pH		
Temperature		
Total Suspended Solids		X
Settleable Solids		X
Conductivity		X
COD		X
BOD		X
Oil & Grease		X
ICP Metals		X
Volatile Halocarbon		X
Volatile Aromatics		X
MBA		X
Pesticides		
Cyanide		X
Boron		X
Petroleum Hydrocarbons		X
Fecal Coliforms		
EP Toxicity	X	
Sulfides		X
Ammonia		X
Phenol		X
SAMPLE TAKEN	Y	Y

C = Contract
Y = Yes
N = No

APPENDIX C

Analyses and Preservation Methods

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Analyses and Preservation Methods for Sites

Analysis	Preservation	Method	Where	Who
pH	None	A423	On Site	AFOEHL
Temperature	None	E170.1	On Site	AFOEHL
Total Suspended Solids	4°C	A209F	Brooks AFB	AFOEHL
Settleable Solids	4°C		Brooks AFB	AFOEHL
Specific Conductance	4°C	E120.1	Brooks AFB	AFOEHL
COD	H_2SO_4	A410.4	On Site & Brooks AFB	AFOEHL
BOD5	4°C	A405.1	On Site	AFOEHL
Oils & Grease Total Recoverable	4°C H_2SO_4	E413.1	Brooks AFB	AFOEHL
ICP Metals *	HNO_3	E200.7	Brooks AFB	AFOEHL
MBAS **	4°C None	E425.1	Brooks AFB	AFOEHL
PHC *** Total Recoverable	4°C H_2SO_4	E418.1	Brooks AFB	AFOEHL
Volatile Halocarbons	4°C	E601	Brooks AFB	AFOEHL
Volatile Aromatics	4°C	E602	Brooks AFB	AFOEHL
Phenols	4°C H_2SO_4	E420	Brooks AFB	AFOEHL
Cyanide	4°C NaOH to pH>12	A412D	Brooks AFB	AFOEHL

Analysis	Preservation	Method	Where	Who
Boron	None	A404A	Brooks AFB	AFOEHL
Organochlorine Pesticides & PCB	4°C	E608	Contract Lab	Data Chem
Sulfides	[illegible] Zinc Acetate	E376	Brooks AFB	AFOEHL
Ammonia	4°C	E376	Brooks AFB	AFOEHL
Kjeldal Total	4°C H_2SO_4	E351	Brooks AFB	AFOEHL
Nitrate	4°C	E353	Brooks AFB	AFOEHL
Nitrite	4°C	E353	Brooks AFB	AFOEHL
EP Toxicity	None		Brooks AFB	AFOEHL
Fecal Coliform	None		On Site	AFOEHL
Chlorine	None		On Site	AFOEHL

Notes: A-indicates Standard Methods for the Evaluation of Water and Wastewater.
E-indicates EPA Methods for Chemical Analysis of Water and Wastes

APPENDIX D

Listing of Shops

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LIST OF ACTIVE OIL/WATER SEPARATORS & INTERCEPTORS

No.	Site Location	Bldg
1	AAFES Gas Station	177
2	Wash Rack	192
3	Auto Hobby Shop	248
4	Vehicle Maint Shop	291
5	POL Operation	328
6	Vehicle Maint Yard	330
7	Pave. & Equip Shop	338
8	BCE Shops	339
9	BCE Wash Rack	341
10	POL Bulk Storage	351
11	Refueler Maint	353
12	AGE Wash Rack	403
13	Support Equip Shop	404
14	A/C Maint Dock	408
15	A/C Maint Dock	431
16	A/C Maint & Trng	485
17	405th Arm Shop	492
18	Flight Sim Bldg	617
19	Flight Sim Bldg	617
20	Flight Sim Bldg	617
21	Industr Waste Treat	912
22	A/C Maint Dock	915
23	Corrosion Control	922
24	Corrosion Control	922
25	Armament Shop	926
26	Org Maint Shop	927
27	Engine Shop	931
28	Flight Simulator	940
29	Battery Storage	947
30	NDI Lab	966
31	Fuel Barn	968
32	AGE Yard	970
33	Hydrazine Facility	982
34	A/C Maint Dock	983
35	A/C Maint Dock	983
36	Fuel Barn	984
37	A/C Maint Dock	985
38	A/C Maint Dock	985
39	Comp Maint Facil	993
40	A/C Maint Dock	999
41	Power Check Pad	1003
42	Hush House	1006
43	Power Check Pad	1008
44	Power Check Pad	1009
45	Hush House	1012
46	Hush House	1016
47	AGE Shop	1018
48	Fuel Barn	1019
49	A/C Maint Dock	1022
50	Vehicle Wash Rack	1233

Sanitary Sites

No.	Site Location	Bldg
51	MH3 From Fig 4 Near 935	935
52	MH6 Near 972	972
53	CB 8 near N. 919 on W.	919
54	CB 13 Near MH3	935
55	CB 17 Near Bldg 959	959
56	Influent to STP	STP
57	Effluent From STP	STP
58	MH near housing	housing
59	Pump Station #901	901
60	LS near 793	793
61	2nd Str. near 585	585
62	4th near 546	546
63	5th and I	---
64	2nd and K	---
65	Litchfield Rd	---
66	Near Bldg 799	799
67	O/W Sep South Drain	912
68	58 EMS Phase Docks	985
69	58 EMS Corrosion Control	922
70	Entomology	337
71	Photo Lab	---
72	Hospital/Dental Clinic	1130
73	944 CAMS NDI	1022
74	Propulsion	993
75	Burger King	---
76	Auto Hobby	248
77	Dining Facility	---
78	NCO Club	---
79	O' Club	---
80	Commissary	---
81	8th and I	---
82	Fire Station	---
83	40 SEMS NDI	---
84	Zone I - Falcon	921
85	Zone 4 - Tiger	339
86	405 EMS Phase Docks	914
87	944 CAMS Phase Docks	999
88	58 EMS AGE	930A
89	405 EMS AGE	404
90	944 CAMS AGE	1018
91	607 TCTS AGE	1382
92	Power Plant	---
93	Bldg 95[illegible]	
94	Hush House	
95	Bldg 353	

No.	Site Location	Bldg
96	Bldg 339	
97	Bldg 347	
98	Bldg 346	
99	Bldg 931	
100	CB 6 Sludge sample	
101	STP Sludge	
102	Pizza Hut Other housing area	
103	Outfall of the STP	

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APPENDIX E

EPA Method 601 Results

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TEST	Units	SITE 3	12	13	14	15
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	69	<0.3	<0.3	<0.3	<0.3
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	141	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	132	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	14	<0.4	<0.4	<0.4	<0.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	1644	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	699	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	169	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L	883				

TEST	Units	SITE 16	17	18	22	23	24
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	<0.5	1.6	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	1	<0.4	<0.4	<0.4	1044	2.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	2.1	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

TEST	Units	SITE 25	26	30	39	54	55
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	0.9	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	4.5
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodiflucromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	1.1	<0.4	15	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	1	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	5.3	<0.5	0.7	<0.5	<0.5	17
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	0.9	<0.4	1.4	1.1	<0.4	<0.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	0.5	<0.5	998	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

TEST	Units	SITE 55	56	56	56	57	57
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	<0.3	3.8	<0.3	<0.3	1.1
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

TEST	Units	SITE 57	58	58	59	59	60
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	5.9	<0.3	5.9	<0.3	8
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	8.5
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	.34	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

TEST	Units	SITE 60	61	61	63	63	64
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	**3.2**	<0.3	**47**	<0.3	**4.6**
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

TEST	Units	SITE 64	65	67	67	68	72
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	<0.3	<0.3	3.4	<0.3	<0.3
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	5	<0.5	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	23	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

		SITE					
TEST	Units	74	76	81	85	85	103
Bromodichloromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Bromoform	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Carbon Tetrachloride	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chloroethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Chloroform	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloromethane	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chlorodibromomethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Dichlorodifluoromethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
1,1-Dichloroethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-Dichloroethane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,1-Dichloroethene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
trans-1,2-Dichloroethene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
cis-1,3-Dichloropropen	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1,2,2-Tetrachloroethan	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
1,1,1-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl chloride	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Bromomethane	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2-Chloroethylvinyl ehter	ug/L	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
cis-1,2-Dichloroethene	ug/L						

APPENDIX F

Analytical Results

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Test	Units	SITE 3	12	13	14
COD	mg/l	7075	330	4150	135
Ammonia	mg/l	6	0.28	16	0.2
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.017	<0.005	0.005	0.005
Phenol	ug/l	225	165	166	37
Boron	ug/l	10250	1150	12000	300
Residue, Settleable	ml/L	<0.2	0.2	0.7	0.3
Residue, Total	mg/l	3219	470	1919	484
Surfactants-MBAS	mg/l	216	26	164	2.7
Sulfides	mg/l	0.1	<0.1	<0.1	0.1
Oil & Grease (IR)	mg/l	415.2	168	238.4	
Oil & Grease (EPA-418.1)	mg/l	316	143.2	115.2	
Specific conductance	umhos	1450	600	1056	613

Test	Units	SITE 15	16	17	18
COD	mg/l	3800	250	2650	14500
Ammonia	mg/l	33	2.8	21.6	2.84
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	<0.005	<0.005	0.04	<0.005
Phenol	ug/l	320	675	295	73
Boron	ug/l	1400	400	3100	67000
Residue, Settleable	ml/L	<0.2	<0.2	<0.2	6.5
Residue, Total	mg/l	1745		1723	3881
Surfactants-MBAS	mg/l	9.8	7.6	4.3	5.8
Sulfides	mg/l	3.1	1.7	4.5	
Oil & Grease (IR)	mg/l	332.8	2160	416	5.4
Oil & Grease (EPA-418.1)	mg/l	249.6	1248	166	4.5
Specific conductance	umhos	1019	538	898	15000

		SITE			
Test	Units	22	23	24	25
COD	mg/l	135	100	125	520
Ammonia	mg/l	2.04	<0.2	1.76	5.6
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.012	0.012	0.007	0.031
Phenol	ug/l	38	17500	16	17
Boron	ug/l	3200	<200	700	400
Residue, Settleable	ml/L	0.3	0.5	0.4	0.2
Residue, Total	mg/l	551	549	574	508
Surfactants-MBAS	mg/l	1.1	0.2	5.2	0.1
Sulfides	mg/l	<0.1	<0.1	0.1	6.1
Oil & Grease (IR)	mg/l	3.5		4.2	296
Oil & Grease (EPA-418.1)	mg/l	2.1		3.3	30.7
Specific conductance	umhos	608	708	794	831

		SITE			
Test	Units	26	30	39	54
COD	mg/l	400	50	105	1650
Ammonia	mg/l	5.6	16.8	0.24	0.28
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.028	<0.005	<0.005	0.006
Phenol	ug/l	13	20	<10.0	33
Boron	ug/l	1900	650	350	500
Residue, Settleable	ml/L	0.2	0.5	5.2	0.6
Residue, Total	mg/l	486	472	957	1143
Surfactants-MBAS	mg/l	2.4	0.3	2.8	320
Sulfides	mg/l	0.1	6.7	0.1	1
Oil & Grease (IR)	mg/l	31.8	3.8	48	16.7
Oil & Grease (EPA-418.1)	mg/l	5.8	3.5	12	9.6
Specific conductance	umhos	423	633	623	1081

		SITE			
Test	Units	55	55	56	56
COD	mg/l	2520	1100	232	230
Ammonia	mg/l	2.3	1.78	26.8	25.6
TKN	mg/l			25	23
Nitrates (as nitrogen)	mg/l			<0.1	<0.1
Nitrites (as nitrogen)	mg/l			0.03	0.05
Cyanide	mg/l	0.01	0.017	0.005	0.005
Phenol	ug/l	66	80	33	45
Boron	ug/l	650	650	700	850
Residue, Settleable	ml/L	1.2	<0.2		1
Residue, Total	mg/l	1171	1035		530
Surfactants-MBAS	mg/l	1120	230	9.4	0.2
Sulfides	mg/l	8.1	1.1	0.7	0.5
Oil & Grease (IR)	mg/l		250.8		48
Oil & Grease (EPA-418.1)	mg/l		53.6		9.3
Specific conductance	umhos	969	988	831	919

		SITE			
Test	Units	56	56	57	57
COD	mg/l	222		70	92
Ammonia	mg/l	26.6		22.4	20
TKN	mg/l	22		17	17
Nitrates (as nitrogen)	mg/l	<0.1		0.42	0.34
Nitrites (as nitrogen)	mg/l	0.05		0.05	<0.02
Cyanide	mg/l	0.007		0.015	0.017
Phenol	ug/l	45		10	<10.0
Boron	ug/l	1000		2400	
Residue, Settleable	ml/L	1.4	2.7	<0.2	
Residue, Total	mg/l	451	455	560	
Surfactants-MBAS	mg/l	18		0.8	1.5
Sulfides	mg/l	6.6		<0.1	<0.1
Oil & Grease (IR)	mg/l	72	17.6	8.4	
Oil & Grease (EPA-418.1)	mg/l	19.7	2.8	3.9	
Specific conductance	umhos	951		861	863

		SITE			
Test	Units	57	57	57	58
COD	mg/l	85	70		400
Ammonia	mg/l	19.6	17.1		21.6
TKN	mg/l	17	16		
Nitrates (as nitrogen)	mg/l	0.44	0.4		
Nitrites (as nitrogen)	mg/l	<0.02	<0.02		
Cyanide	mg/l	0.007	0.014		0.006
Phenol	ug/l	<10.0	10		54
Boron	ug/l	1850	1350		1050
Residue, Settleable	ml/L		<0.2	<0.2	33.3
Residue, Total	mg/l		444	447	166
Surfactants-MBAS	mg/l	0.4	2.6		5.2
Sulfides	mg/l	<0.1	<0.1		2.1
Oil & Grease (IR)	mg/l		5.9	2.1	268
Oil & Grease (EPA-418.1)	mg/l		2.7	1.7	17.6
Specific conductance	umhos	763	794		956

		SITE			
Test	Units	58	59	59	60
COD	mg/l	510	303	560	285
Ammonia	mg/l	19.6	56.8	56	22
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.005	0.005	0.007	0.015
Phenol	ug/l	70	42	60	31
Boron	ug/l	1250	1700	5750	850
Residue, Settleable	ml/L	2.8	1.1	1.3	9.2
Residue, Total	mg/l	406	471	623	1339
Surfactants-MBAS	mg/l	6.8	0.2	0.2	0.2
Sulfides	mg/l		0.7	0.1	10.8
Oil & Grease (IR)	mg/l	86	9.6	51.6	356
Oil & Grease (EPA-418.1)	mg/l	14.2	4.2	17.2	46.4
Specific conductance	umhos	844	1063	1245	960

		SITE			
Test	Units	60	61	61	63
COD	mg/l	380	240	180	475
Ammonia	mg/l	31.2	12.8	15.6	81.6
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.013	0.005		0.01
Phenol	ug/l	33	10		123
Boron	ug/l	1400	650		1050
Residue, Settleable	ml/L	0.8	<0.2		32.9
Residue, Total	mg/l	480	10406		1849
Surfactants-MBAS	mg/l	0.2	4.4		0.9
Sulfides	mg/l	0.7	1.1		1.7
Oil & Grease (IR)	mg/l	65.6	131.2	179.2	25.2
Oil & Grease (EPA-418.1)	mg/l	14.2	17.8	89.4	5.3
Specific conductance	umhos	981	691		1383

		SITE			
Test	Units	63	64	64	65
COD	mg/l	220	280	140	415
Ammonia	mg/l	66	46	22.8	27
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.006	0.006	0.007	
Phenol	ug/l	52	37	37	23
Boron	ug/l	1050	1400	1625	850
Residue, Settleable	ml/L	8.9	<0.2	0.03	2.5
Residue, Total	mg/l	523	579	510	635
Surfactants-MBAS	mg/l	0.2	0.2	0.1	2
Sulfides	mg/l	4	0.5	<0.1	3.1
Oil & Grease (IR)	mg/l	65.6	96	57.6	240
Oil & Grease (EPA-418.1)	mg/l	15.1	35.6	14.4	87.6
Specific conductance	umhos	1300	988	1169	856

		SITE			
Test	Units	65	66	66	67
COD	mg/l	335	260	193	710
Ammonia	mg/l	21.4	10	13	0.36
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l				0.005
Phenol	ug/l	52			240
Boron	ug/l	650	500	550	650
Residue, Settleable	ml/L	0.7		0.5	
Residue, Total	mg/l	476		521	
Surfactants-MBAS	mg/l	0.2		<0.1	1250
Sulfides	mg/l	1			0.1
Oil & Grease (IR)	mg/l	65.6		89.6	
Oil & Grease (EPA-418.1)	mg/l	8.6		10.1	
Specific conductance	umhos	900	831	931	1013

		SITE			
Test	Units	67	71	72	74
COD	mg/l	284			185
Ammonia	mg/l	7.8			50.4
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.012			0.006
Phenol	ug/l	187			31
Boron	ug/l	900			1400
Residue, Settleable	ml/L	0.9	2.4	0.3	
Residue, Total	mg/l	821	428	580	
Surfactants-MBAS	mg/l	2.6			<0.1
Sulfides	mg/l	1.6			1.3
Oil & Grease (IR)	mg/l	208	8.9	2.1	
Oil & Grease (EPA-418.1)	mg/l	179.2	1.8	<1.0	
Specific conductance	umhos	838			1175

Test	Units	SITE 74	75	76	77
COD	mg/l	150	270	240	93
Ammonia	mg/l	9.4	12.8	64	14
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	<0.005	0.006	0.008	0.27
Phenol	ug/l	60	80	24	27
Boron	ug/l	1350	750	1850	750
Residue, Settleable	ml/L				2.4
Residue, Total	mg/l				428
Surfactants-MBAS	mg/l	0.1	0.5	0.4	0.1
Sulfides	mg/l	<0.1	0.3	<0.1	1.6
Oil & Grease (IR)	mg/l			70.4	8.9
Oil & Grease (EPA-418.1)	mg/l			10.6	1.8
Specific conductance	umhos	1081	1700	1150	511

Test	Units	SITE 78	79	80	81
COD	mg/l	230	350	220	240
Ammonia	mg/l	10.4	49	18.8	84
TKN	mg/l				
Nitrates (as nitrogen)	mg/l				
Nitrites (as nitrogen)	mg/l				
Cyanide	mg/l	0.005	0.005	0.007	0.015
Phenol	ug/l	<10.0	170	109	102
Boron	ug/l	750	2000	500	1200
Residue, Settleable	ml/L	0.3	0.3	1.3	2.7
Residue, Total	mg/l	436	475	461	823
Surfactants-MBAS	mg/l		0.6	0.2	0.2
Sulfides	mg/l	0.4	0.2	0.4	1.8
Oil & Grease (IR)	mg/l	70.4	27.2	6.9	17.6
Oil & Grease (EPA-418.1)	mg/l	5.8	8.9	1.7	4.3
Specific conductance	umhos		626	1175	1875

Test	Units	SITE 82	85	85
COD	mg/l	118	490	265
Ammonia	mg/l	73	22	37.5
TKN	mg/l			
Nitrates (as nitrogen)	mg/l			
Nitrites (as nitrogen)	mg/l			
Cyanide	mg/l	0.013	0.006	
Phenol	ug/l	63	48	109
Boron	ug/l	900	4300	2300
Residue, Settleable	ml/L	0.4		
Residue, Total	mg/l	600		
Surfactants-MBAS	mg/l	0.1	2.9	1.5
Sulfides	mg/l	<0.1	0.7	
Oil & Grease (IR)	mg/l	2.4		70.4
Oil & Grease (EPA-418.1)	mg/l	<1.0		12.5
Specific conductance	umhos	1550	1363	1500

APPENDIX G

Metals Analysis Results

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Test	Units	SITE 3	12	13	14	15	16
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	*	337	*	127	*
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	165	*	*	*
Calcium	mg/L	61.8	24.7	62.1	49.2	42.4	45.7
Chromium	ug/L	*	*	261	*	*	*
Copper	ug/L	235	*	285	*	*	*
Iron	ug/L	167200	360	11840	433	6589	4337
Manganese	ug/L	1134	*	204	*	139	199
Nickel	ug/L	3500	*	*	*	*	*
Zinc	ug/L	862	231	2817	*	218	540
Aluminum	ug/L	1640	235	3008	*	1045	238
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	9498	*	504	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	*	22.9	*	*	*
Magnesium	mg/L	16.3	11.3	16.6	20.9	15.3	8.8

Test	Units	SITE 17	18	22	23	24	25
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	926	2690	*	369	*	1339
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	136
Calcium	mg/L	49	15920	45	60	34.4	45
Chromium	ug/L	*	*	*	542	*	*
Copper	ug/L	*	150	*	*	*	128
Iron	ug/L	2997	161200	1523	980	6719	1035
Manganese	ug/L	142	517	133	127	127	*
Nickel	ug/L	*	3000	*	*	*	*
Zinc	ug/L	4131	297	*	*	*	290
Aluminum	ug/L	617	*	*	*	*	161
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	175	*	*	*	*	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	1.8	*	*	*	*
Magnesium	mg/L	11.1	4964	7.9	24	20.3	18.5

Test	Units	SITE 26	30	39	53 Sludge	54	55
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	1803	*	*	237.2	*	*
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	26.5	25.8	48.3	3.2	51.1	61.1
Chromium	ug/L	*	*	*	16.9	*	*
Copper	ug/L	*	*	*	17.6	*	*
Iron	ug/L	1780	1869	490	3526	353	614
Manganese	ug/L	205	*	*	47	*	*
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	102	*	*	50.1	101	110
Aluminum	ug/L	*	409	187	1877	353	324
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	*	150	175	264
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	*	*	*	*	*
Magnesium	mg/L	7	10.8	20.4	1.2	22.2	24.1

Test	Units	SITE 55	56	56	56	57	57A
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	*	*	148	*	*
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	53.9	29.2	26.5	29.4	26.8	27.4
Chromium	ug/L	*	*	*	*	*	*
Copper	ug/L	*	*	*	*	*	*
Iron	ug/L	497	886	354	1205	330	211
Manganese	ug/L	*	*	*	*	*	*
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	*	109	*	125	*	*
Aluminum	ug/L	336	260	130	398	2787	2098
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	232	*	*	*	*	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	*	*	*	*	*2.4
Magnesium	mg/L	21.4	12	12.2	11.7	13	12.2

		SITE					
Test	Units	57	57	58	58	59	59
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	*	*	*	*	*
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	24.9	24.5	41.3	32.1	50.1	52.4
Chromium	ug/L	*	*	*	*	*	*
Copper	ug/L	*	*	*	*	*	*
Iron	ug/L	134	255	1398	1491	935	290
Manganese	ug/L	*	*	*	*	*	*
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	*	*	123	213	133	*
Aluminum	ug/L	2464	2212	271	487	244	128
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	*	*	*	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	239	*
Mercury	ug/L	*	2.3	*	*	*	*
Magnesium	mg/L	11.9	11.4	14.1	11.5	21.2	23.5

		SITE					
Test	Units	60	60	61	61	63	63
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	289	*	*	*	137
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	29.5	52.3	25.3	23.3	36.2	53.8
Chromium	ug/L	*	*	*	*	*	*
Copper	ug/L	*	*	*	*	*	*
Iron	ug/L	1620	26150	354	380	1246	8201
Manganese	ug/L	*	117	*	*	*	145
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	170	1395	*	*	306	670
Aluminum	ug/L	244	2814	*	122	396	1764
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	122	*	*	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	*	*	*	*	*
Magnesium	mg/L	13.2	15.3	11.8	9.9	14.1	13.6

Test	Units	SITE 64	64	65	67	67	72
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	*	*	*	141	132
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	40.9	36	21.6	66.1	67.8	21.8
Chromium	ug/L	*	*	*	*	*	*
Copper	ug/L	*	*	*	*	*	*
Iron	ug/L	1392	364	556	798	5107	8102
Manganese	ug/L	*	*	*	122	193	*
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	194	*	103	*	364	*
Aluminum	ug/L	320	106	120	161	2430	541
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	*	112	*	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	*	*	*	*	*
Magnesium	mg/L	16.5	16.1	10.1	26.3	23.3	10.3

Test	Units	SITE 73	74	75	76	77	78
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	*	*	*	*	*
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	*	50.7	27.7	24.4	29.9	23.2
Chromium	ug/L	*	*	*	*	*	*
Copper	ug/L	*	*	*	*	*	*
Iron	ug/L	*	298	930	308	3592	303
Manganese	ug/L	*	*	*	*	*	*
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	*	127	124	166	340	*
Aluminum	ug/L	*	117	127	161	518	122
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	*	*	*	*
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	211	*	*	*	*
Mercury	ug/L	*	*	1.3	2.1	*	*
Magnesium	mg/L	*	21.9	12.2	11.2	10.3	9.2

Test	Units	SITE 79	80	81	82	83	85
Arsenic	ug/L	*	*	*	*	*	*
Barium	ug/L	*	*	*	*	*	*
Beryllium	ug/L	*	*	*	*	*	*
Cadmium	ug/L	*	*	*	*	*	*
Calcium	mg/L	22.8	26.2	30.1	22.2	39.3	55.2
Chromium	ug/L	*	*	*	*	*	*
Copper	ug/L	*	*	*	*	*	*
Iron	ug/L	697	594	960	322	628	712
Manganese	ug/L	*	*	*	*	*	*
Nickel	ug/L	*	*	*	*	*	*
Zinc	ug/L	280	204	188	*	249	748
Aluminum	ug/L	324	258	337	106	194	689
Cobalt	ug/L	*	*	*	*	*	*
Titanium	ug/L	*	*	*	*	123	3165
Vanadium	ug/L	*	*	*	*	*	*
Molybdenum	ug/L	*	*	*	*	*	*
Mercury	ug/L	*	*	*	*	2.1	*
Magnesium	mg/L	9.7	10.9	12.7	11.2	12	12.4

Test	Units	SITE 94	99	102	103
Arsenic	ug/L	*	*	*	*
Barium	ug/L	*	221	*	*
Beryllium	ug/L	*	*	*	*
Cadmium	ug/L	*	161	*	*
Calcium	mg/L	66.6	44.8	26.2	27.4
Chromium	ug/L	*	191	*	*
Copper	ug/L	*	201	*	*
Iron	ug/L	545	7292	162	195
Manganese	ug/L	*	301	*	*
Nickel	ug/L	*	266	*	*
Zinc	ug/L	177	8457	*	*
Aluminum	ug/L	*	2838	168	3811
Cobalt	ug/L	*	*	*	*
Titanium	ug/L	*	673	*	*
Vanadium	ug/L	*	*	*	*
Molybdenum	ug/L	*	148	*	*
Mercury	ug/L	1.8	20.1	*	*
Magnesium	mg/L	27.7	19.8	13.2	12.8

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APPENDIX H

EPA Method 602 Results

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		SITE					
TESTS	Units	3	3	12	13	14	15
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	3	<0.5
1,4-Dichlorobenzene	ug/L	5.2	<0.7	<0.7	<0.7	10	<0.7
Ethyl benzene	ug/L	2.7	<0.3	4	<0.3	1.9	<0.3
Chlorobenzene	ug/L	6	<0.6	<0.6	<0.6	<0.6	<0.6
Toluene	ug/L	34	<0.3	29	<0.3	<0.3	<0.3
Benzene	ug/L	<0.5	<0.5	8	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<0.5 look	<1.0	<1.0	<1.0	<1.0	<1.0

		SITE					
TESTS	Units	17	22	23	24	25	26
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	-	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.5	<0.5	-	<0.7	<0.7
Ethyl benzene	ug/L	960	<0.5	0.7	-	<0.3	<0.3
Chlorobenzene	ug/L	<0.6	<0.5	2.5	-	<0.6	<0.6
Toluene	ug/L	80	<0.5	1.3	-	<0.3	<0.3
Benzene	ug/L	<0.5	2.7	<0.5	-	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<0.5	<0.5	-	<1.0	<1.0

		SITE					
TESTS	Units	39	54	55	56	56	56
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.5	<0.7	<0.7	<0.5	<0.5	<0.7
Ethyl benzene	ug/L	<0.5	<0.3	<0.3	<0.5	6	8.7
Chlorobenzene	ug/L	<0.5	<0.6	<0.6	<0.5	.8	9.2
Toluene	ug/L	1.2	<0.3	<0.3	69	21	17
Benzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0

		SITE					
TESTS	Units	57	57	57	58	58	59
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Ethyl benzene	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	3.4
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Toluene	ug/L	<0.3	3	<0.3	2.5	<0.3	42
Benzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

		SITE					
TESTS	Units	59	60	60	61	61	63
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Ethyl benzene	ug/L	<0.3	15	11	<0.3	<0.3	<0.3
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Toluene	ug/L	<0.3	54	22	<0.3	4	<0.3
Benzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

		SITE					
TESTS	Units	64	64	65	67	67	68
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Ethyl benzene	ug/L	3.2	67	1.9	<0.3	120	4
Chlorobenzene	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Toluene	ug/L	45	<0.3	5.8	9.2	270	<0.3
Benzene	ug/L	<0.5	<0.5	5.8	<0.5	60	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

		SITE					
TESTS	Units	72	74	76	76	81	85
1,3-Dichlorobenzene	ug/L	<0.5	<0.5	<0.5	**	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	<0.5	<0.7	<0.7	**	<0.7	<0.7
Ethyl benzene	ug/L	<0.5	<0.3	<0.3	**	<0.3	[illegible]
Chlorobenzene	ug/L	<0.5	<0.6	<0.6	**	<0.6	<0.6
Toluene	ug/L	28	<0.3	<0.3	**	<0.3	<0.3
Benzene	ug/L	<0.5	<0.5	<0.5	**	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	<0.5	<1.0	<1.0	**	<1.0	<1.0

		SITE	
TESTS	Units	85	103
1,3-Dichlorobenzene	ug/L	<0.[illegible]	<0.5
1,4-Dichlorobenzene	ug/L	<0.7	<0.7
Ethyl benzene	ug/L	[illegible]	<0.3
Chlorobenzene	ug/L	<0.6	<0.6
Toluene	ug/L	12	<0.3
Benzene	ug/L	[illegible]	<0.5
1,2-Dichlorobenzene	ug/L	<1.0	<1.0

APPENDIX I

Bioassay Results

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AFOEHL/EQE BIOASSAY RECORD SHEET

TEST NUMBER: D0114348891

BASE SAMPLE NUMBER: GN890794

SAMPLE SITE: SEWAGE TREATMENT PLANT EFFLUENT

REQUESTING AGENCY INFORMATION

UNIT	OFC SYM	INSTALLATION	ST	ZIP
832 MEDICAL GROUP	SGPB	LUKE AFB	AZ	85309

REQUESTOR: LT FRYER AUTOVON NUMBER: 853 1ST EXT: 7521 2ND EXT:

TRACKING INFORMATION

DATE OF RECEIPT: 14-DEC-89 PROJECT MANAGER: 2LT CURTIS (AFOEHL/EQE) PROJECT TECHNICIAN: SSGT ROLON, AMN DILLON

REMARKS: SPECIAL REQUEST WHILE AFOEHL/EQE WERE TDY TO LUKE AFB

DATE/TIME SAMPLE COLLECTED/ENDED: 13-DEC-89 @ 0900 (GRAB SAMPLE)

ORGANISM: DAPHNIA PULEX LC50: DURATION: 48 HOURS

ANALYTICAL INFORMATION

CONTROL WATER/TYPE: RECON MOD HARD ALKALINITY: 52 HARDNESS: 90 CL: 0 SAMPLE: ALK 184, HARD 120, CL 0

SAMPLE START DATA

START DATE: 14-DEC-89 START TIME: 1630

	1	2	3	4	5	6	7
STARTING NUMBER:	20	20	20	20	20	20	
DILUTION PERCENT:	0.00	6.25	12.5	25	50	100	
DO:	8.0	8.0	8.1	8.3	8.4	8.6	
PH:	8.2	8.2	8.1	8.0	8.0	7.8	
TEMP (C):	20.2	20.2	20.0	20.1	20.1	20.0	
INTERVAL: 24 HOURS							
SURVIVING NUMBER:	20	20	20	12	0	0	
SURVIVAL PERCENT:	100	100	100	60	0	0	
DO:	8.6	9.1	9.0	9.0	8.5	8.6	
PH:	7.0	8.0	7.9	7.9	8.1	8.0	
TEMP (C):	20.5	21.4	21.0	20.2	19.4	20.4	
INTERVAL: 48 HOURS							
SURVIVING NUMBER:	20	20	20	6	0	0	
SURVIVAL PERCENT:	100	100	100	30	0	0	
DO:	9.5	9.4	9.3	9.4			
PH:	7.5	7.6	7.7	7.8			
TEMP (C):	19.3	20.2	20.3	19.6			
INTERVAL: 72 HOURS							
SURVIVING NUMBER:							
SURVIVAL PERCENT:							
DO:							
PH:							
TEMP (C)							
INTERVAL: 96 HOURS							
SURVIVING NUMBER:							
SURVIVAL PERCENT:							
DO:							
PH:							
TEMP (C):							

TEST NOTES

CONCENTRATIONS WERE RENEWED AT 24 HOURS. BIOASSAY FAILED

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ATCH 7

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APPENDIX J

Fecal Coliform Results

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BASE_____ TECH_____

FECAL COLIFORM SAMPLE RESULTS

Date of sample	Date of Analysis	Site Identification	Dilution	Calculation	Fecal /100ml	Remarks
12/14/89	12/15/89	CB 17	.001	(32 x 100) ÷ .001	3200000	
"	"		.0001	0	0	
"	"		.0005	(19 x 100) ÷ .0005	6400000	
"	"		.00005	0	0	
"	"		.000005	0	0	
Mid Control	12/15/89	0	0	0	0	
12/14/89	12/15/89	#56	.001	TNTC	TNTC	
"	"		.0001	(240 x 100) x .0001	240000000	
"	"		.0005	—	—	Sample damaged
"	"		.00005	(38 x 100) ÷ .00005	760000000	
"	"		.000005	(13 x 100) ÷ .000005	2.6×10^{10}	
12/14/89	12/15/89	MH6	.001	(6 x 100) ÷ .001	600000	
"	"		.0001	0	0	
"	"		.0005	(3 x 100) ÷ .0005	600000	
"	"		.00005	0	0	
"	"		.000005	0	0	
Post Control		0		0	0	

SE _____ TECH _____

FECAL COLIFORM SAMPLE RESULTS

Lamp ✓ 44.5 14 Dec 1500

Date of sample	Date of Analysis	Site Identification	Dilution	Calculation	Fecal /100ml	Remarks
12/14/89	12/15/89	C 13	.001	(1 X100) ÷ .001	100000	
"	"	C 13	.0001	0	0	
"	"	C 13	.0005	(2 X100) ÷ .005	400000	
"	"	C 13	.000005	0	0	
"	"	C 13	.0000005	0	0	
Pre Control	~~0~~			0	0	
12/14/89	12/15/89	CB 8	.001	(117 X100) ÷ .001	11700000	
"	"	CB 8	.0001	(68 X100) ÷ .0001	68000000	
"	"	CB 8	.0005	(110 X100) ÷ .0005	22000000	
"	"	CB 8	.00005	(2 X100) ÷ .00005	40000000	
"	"	CB 8	.000005	0	0	
12/14/89	12/15/89	# 57	.001	0	0	
"	"	# 57	.0001	0	0	
"	"	# 57	.0005	0	0	
"	"	# 57	.00005	0	0	
"	"	# 57	.000005	0	0	

Distribution List

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